Center Innovation Fund: AFRC CIF

Acoustic Diagnostics of Turbofan Health Monitoring

Completed Technology Project (2011 - 2015)

Project Introduction

This unique innovation employs an array of external microphones to pinpoint faults within turbofan engines. The development team partnered with Armstrong's Vehicle Integrated Propulsion Research (VIPR) effort by piggybacking onto an existing field test. After a successful demonstration, the project is now part of the VIPR program, which will fund the work going forward.

Work to date: The team has achieved several significant technical accomplishments, most notably the successful recording of VIPR turbofan engine data with external microphones. In this particular test, bleed valve failures were induced at both high- and low-pressure compressor stages within an engine and the data were recorded. The team then developed software algorithms to identify engine faults within acoustic data and applied these algorithms to the recorded data, successfully identifying the bleed valve failures in the high-pressure stage.

Looking ahead: Identifying faults at low-pressure stages will require a system with greater sensitivity; therefore, the team plans to use additional experimental recorded data to show how an array of microphones can detect quieter faults.

Benefits

- **Accurate:** Uses an innovative array configuration to pinpoint the exact location of a fault within an engine
- **Efficient:** Optimizes condition-based maintenance so that service occurs only when needed rather than at predetermined times
- **Improves safety:** Identifies faults before they cause catastrophic damage

Applications

- Aircraft engines, commercial rail, and trucks
- Military land transport vehicles

Anticipated Benefits

- **Accurate:** Uses an innovative array configuration to pinpoint the exact location of a fault within an engine
- **Efficient:** Optimizes condition-based maintenance so that service occurs only when needed rather than at predetermined times
- **Improves safety:** Identifies faults before they cause catastrophic damage

Turbofan

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Center Innovation Fund: AFRC CIF

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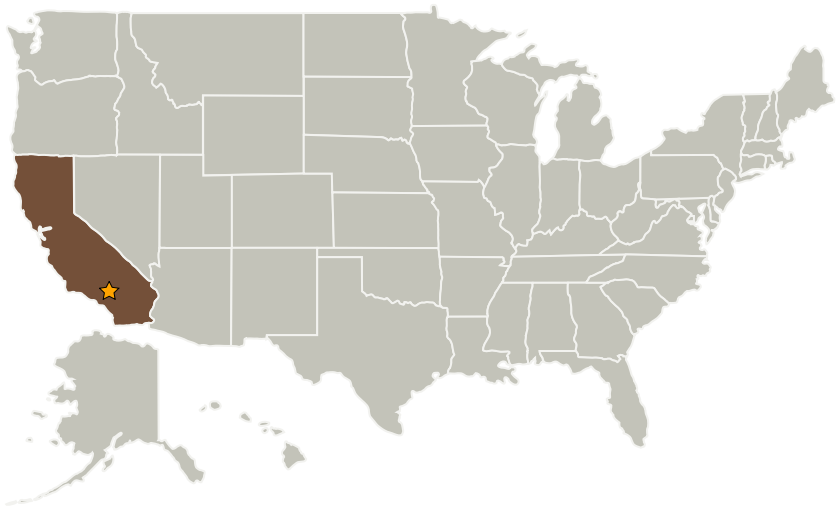
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California

Primary U.S. Work Locations
California

Project Management

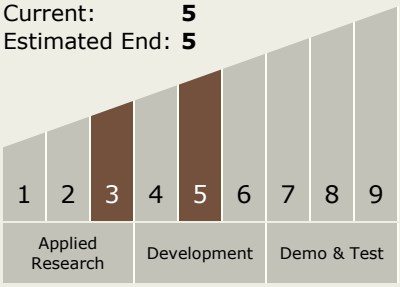
Program Director:
Michael R Lapointe

Program Manager:
David F Voracek

Principal Investigator:
Davin Boyle

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.6 Advanced Life-Cycle Testing Techniques

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Images

Turbofan
Turbofan
(https://techport.nasa.gov/image/16316)